EXHIBIT 2

(19)日本国特許庁（ＪＰ）　(12) 公開特許公報（Ａ）　(11)特許出願公開番号

特開平11－60904

(43)公開日　平成11年(1999)３月５日

(51)Int.Cl.[6]	識別記号	ＦＩ	
Ｃ０８Ｌ　63/00		Ｃ０８Ｌ　63/00	Ｂ Ｃ
Ｃ０８Ｋ　3/00 3/04 5/23		Ｃ０８Ｋ　3/00 3/04 5/23	

審査請求　未請求　請求項の数４　ＯＬ　（全６頁）　最終頁に続く

(21)出願番号　特願平9－228695

(22)出願日　平成９年(1997)８月26日

(71)出願人　000005832
松下電工株式会社
大阪府門真市大字門真1048番地
(72)発明者　原　竜三
大阪府門真市大字門真1048番地松下電工株式会社内
(72)発明者　外山　貴志
大阪府門真市大字門真1048番地松下電工株式会社内
(72)発明者　郷田　孝則
大阪府門真市大字門真1048番地松下電工株式会社内
(74)代理人　弁理士　西川　惠清　（外１名）

最終頁に続く

(54)【発明の名称】　封止用エポキシ樹脂組成物及び半導体装置

(57)【要約】
【課題】　鮮明なレーザマークを形成することができると共に可視光及び赤外光の透過を抑制することができ、しかも耐湿信頼性に優れた封止用エポキシ樹脂組成物を提供する。
【解決手段】　エポキシ樹脂、硬化剤、硬化促進剤、無機充填剤を主成分とする。これにさらに平均粒径が２０ｎｍ以下でｐＨが７．０以上のカーボンブラックを０．０５～０．５重量%、アゾ系有機染料を０．０５～０．５重量%それぞれ配合する。アゾ系有機染料の配合によってレーザーマークの鮮明度を高めることができ、またカーボンブラックの配合によって可視光及び赤外光の透過を抑制することができる。

1

【特許請求の範囲】

【請求項１】　エポキシ樹脂、硬化剤、硬化促進剤、無機充填剤を主成分とし、平均粒径が２０ｎｍ以下でｐＨが７．０以上のカーボンブラックを０．０５～０．５重量％、アゾ系有機染料を０．０５～０．５重量％それぞれ配合して成ることを特徴とする封止用エポキシ樹脂組成物。

【請求項２】　カーボンブラックの配合量を０．２～０．５重量％にして成ることを特徴とする請求項１に記載の封止用エポキシ樹脂組成物。

【請求項３】　アゾ系有機染料の配合量を０．２～０．５重量％にして成ることを特徴とする請求項１又は２に記載の封止用エポキシ樹脂組成物。

【請求項４】　請求項１乃至３のいずれかの封止用エポキシ樹脂組成物で半導体が封止されて成ることを特徴とする半導体装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、半導体等の電子部品を封止するために用いられる封止用エポキシ樹脂組成物及び、この封止用エポキシ樹脂組成物を用いた半導体装置に関するものである。

【０００２】

【従来の技術】ダイオード、トランジスター、集積回路などの電気、電子部品や半導体装置等の封止方法として、従来から例えば、エポキシ樹脂やシリコン樹脂などによる樹脂封止方法や、ガラス、金属、セラミック等を用いたハーメチックシール法が採用されてきているが、近年では、信頼性の向上と共に大量生産性やコストメリットに優れたエポキシ樹脂組成物を用いた低圧トランスファー成形による樹脂封止が主流を占めるようになっている。このエポキシ樹脂組成物としては、クレゾールノボラック型エポキシ樹脂を樹脂成分とし、フェノールノボラック樹脂を硬化剤成分とするものが最も一般的である。

【０００３】一方、樹脂封止した半導体装置の製品表面に製品名や製造者名等をマーキングするにあたって、従来から熱硬化性樹脂インクを捺印する方法が一般的であるが、インクによるマークは有機溶剤等で比較的容易に消え、また摩擦にも弱いという欠点がある。そこで、これらの欠点を補うと共にマーキング工程の効率化を図るため、CO_2レーザー等のレーザーを樹脂封止した半導体装置の表面に照射することによって、レーザーマーキングで製品名や製造者名等を表示することが行なわれるようになってきている。レーザーマーキングは凹凸でマークを表現するので、有機溶剤や摩擦で消えるようなことがないのである。

【０００４】

【発明が解決しようとする課題】半導体装置の樹脂封止に用いられる封止用エポキシ樹脂組成物には一般にカーボンブラックを配合して黒色に着色されているが、このような黒色の半導体装置の封止成形品の表面に行なうレーザーマーキングは鮮明度に問題があった。そこで、カーボンブラックの替わりに有機染料を配合してレーザーマーキングの鮮明度を高めることが検討されているが、半導体装置の半導体チップを封止する封止樹脂の厚みが薄い場合には、可視光や赤外光が封止成形品を透過し、半導体装置が誤動作するおそれがあり、また半導体装置の耐湿信頼性が低下するおそれがあるという問題があった。

2

【０００５】本発明は上記の点に鑑みてなされたものであり、鮮明なレーザーマークを形成することができると共に可視光及び赤外光の透過を抑制することができ、しかも耐湿信頼性に優れた封止用エポキシ樹脂組成物及び半導体装置を提供することを目的とするものである。

【０００６】

【課題を解決するための手段】本発明に係る封止用エポキシ樹脂組成物は、エポキシ樹脂、硬化剤、硬化促進剤、無機充填剤を主成分とし、平均粒径が２０ｎｍ以下でｐＨが７．０以上のカーボンブラックを０．０５～０．５重量％、アゾ系有機染料を０．０５～０．５重量％それぞれ配合して成ることを特徴とするものである。

【０００７】また請求項２の発明は、カーボンブラックの配合量を０．２～０．５重量％にして成ることを特徴とするものである。また請求項３の発明は、アゾ系有機染料の配合量を０．２～０．５重量％にして成ることを特徴とするものである。本発明に係る半導体装置は、上記の封止用エポキシ樹脂組成物で半導体が封止されて成ることを特徴とするものである。

【０００８】

【発明の実施の形態】以下、本発明の実施の形態を説明する。本発明においてエポキシ樹脂としては、半導体封止用に使用されるものであれば制限されることなく用いることができるが、例えばｏ－クレゾールノボラック型エポキシ樹脂、ビフェニル型エポキシ樹脂、ジシクロペンタジエン型エポキシ樹脂、ビスフェノールＡ型エポキシ樹脂、ビスフェノールＦ型エポキシ樹脂、ブロム含有型エポキシ樹脂などを挙げることができる。

【０００９】また硬化剤としては、エポキシ樹脂硬化用のものであれば特に制限されないが、例えばフェノールノボラック樹脂、クレゾールノボラック樹脂、フェノールアラルキル樹脂、ナフトールアラルキル樹脂、各種の多価フェノール樹脂などのフェノール系樹脂を挙げることができる。さらに硬化促進剤としても特に制限されるものではないが、トリフェニルホスフィン等の有機ホスフィン類、ジアザビシクロウンデセン等の三級アミン、２－メチルイミダゾール、２－フェニルイミダゾール等のイミダゾール類を用いることができる。

【００１０】また無機充填剤としては、溶融シリカ、結晶シリカ、アルミナ、窒化珪素など、半導体封止用に使

用される任意のものを用いることができる。そして本発明では、着色剤としてカーボンブラックを配合するものであるが、カーボンブラックとして平均粒径が２０ｎｍ以下で、且つｐＨが７．０以上のものを用いるものである。カーボンブラックは平均粒径が小さいほうが、封止用エポキシ樹脂組成物中での分散性が向上し、エポキシ樹脂との濡れ性や封止用エポキシ樹脂組成物の成形時の流れ性が向上して、リードフレーム等との密着性が高まるものであり、平均粒径が２０ｎｍを超えるカーボンブラックではこのような効果を期待することはできない。カーボンブラックの平均粒径の下限は特に規定されないが、実用的には１０ｎｍ程度が下限である。またカーボンブラックのｐＨが７．０未満、すなわち酸性であると、ＵＳＰＣＢＴなどの電気特性評価時のリークの原因になると考えられ、樹脂封止した半導体装置の信頼性が低下する。カーボンブラックのｐＨの上限は特に規定されないが、実用的にはｐＨ９．０程度が上限である。このように、カーボンブラックとして平均粒径が２０ｎｍ以下で、且つｐＨが７．０以上のものを用いることによって、樹脂封止した半導体装置の耐湿信頼性を高めることができるものである。

【００１１】さらに本発明では、着色剤としてアゾ系有機染料を配合する。アゾ系染料はアゾ基を発色団に持つ染料であり、塩基性染料、酸性染料、酸性媒染染料、含金属酸性染料、直接染料、アゾイック染料、反応性染料など任意のものを用いることができる。しかして、本発明に係る封止用エポキシ樹脂組成物は、エポキシ樹脂、硬化剤、硬化促進剤、無機充填剤を主成分とし、これに着色剤として上記のカーボンブラックとアゾ系染料を配合し、さらに必要に応じてカルナバワックス、ステアリン酸、モンタン酸、カルボキシル基含有ポリオレフィンなどの離型剤、シランカップリング剤、難燃剤、シリコーン可撓剤などを配合し、これをブレンダー等で均一に混合した後に、ニーダーやロールで加熱混練することによって調製することができるものである。そしてこの混練物を必要に応じて冷却固化し、粉砕して粉状等にして使用するようにしてもよい。

【００１２】ここで、上記各成分の配合量は、封止用エポキシ樹脂組成物の全量中、エポキシ樹脂が１０～２５重量％、硬化剤が５～１３重量％、硬化促進剤が０．１～０．４重量％、無機充填剤が６０～８０重量％の範囲になるように設定するのが好ましい。そしてカーボンブラックの配合量は、封止用エポキシ樹脂組成物の全量に対して０．０５～０．５重量％になるように設定されるものである。カーボンブラックの配合量が０．０５重量％未満であると、封止用エポキシ樹脂組成物で封止した半導体装置の封止成形品に可視光や赤外光が透過することを防止することができなくなり、逆にカーボンブラックの配合量が０．５重量％を超えると、封止用エポキシ樹脂組成物で封止した半導体装置の耐湿信頼性が悪くなり、レーザーマーキングによるマークの鮮明度も悪くなる。可視光や赤外光の透過防止、耐湿信頼性向上、レーザマークの鮮明化の効果が最も良好なカーボンブラックの配合量は、封止用エポキシ樹脂組成物の全量に対して０．２～０．５重量％である。

【００１３】またアゾ系有機染料の配合量は、封止用エポキシ樹脂組成物の全量に対して０．０５～０．５重量％になるように設定されるものである。封止用エポキシ樹脂組成物で封止した半導体装置の封止成形品の表面にCO_2レーザー等のレーザーでレーザーマーキングを行なうにあたって、アゾ系有機染料を配合することによって、発色団を有するアゾ系有機染料による発色によってレーザーマークの凹凸のコントラストを大きくし、レーザーマークの鮮明度を高めることができるようにしたものである。従って、アゾ系有機染料の配合量が０．０５重量％未満ではレーザーマークの鮮明度を高める効果を十分に得ることができない。逆にアゾ系有機染料の配合量が０．５重量％を超えると、封止用エポキシ樹脂組成物で封止した半導体装置の耐湿信頼性が悪くなる。レーザマークの鮮明化及び耐湿信頼性向上の効果が最も良好なアゾ系有機染料の配合量は、封止用エポキシ樹脂組成物の全量に対して０．２～０．５重量％である。

【００１４】このように、レーザマークの鮮明化、可視光や赤外光の透過防止、耐湿信頼性向上の効果を最も良好に得るには、カーボンブラックの配合量を０．２～０．５重量％で且つ、アゾ系有機染料の配合量を０．２～０．５重量％に設定するのが好ましい。そして上記のようにして調製した封止用エポキシ樹脂組成物を用いて封止成形することによって、半導体装置を作製することができる。例えば、ＩＣ等の半導体を搭載したリードフレームをトランスファー成形金型にセットし、低圧トランスファー成形を行なうことによって、半導体を封止用エポキシ樹脂組成物による成形品に封止した半導体装置を作製することができるものである。

【００１５】

【実施例】以下本発明を実施例によって具体的に説明する。表１又は表２に示す各成分を配合し、これをブレンダーで５分間均一に混合し、次いでニーダーを使用して温度８５℃の条件で約５分間混練した後、粉砕することによって、実施例１～４及び比較例１～７の封止用エポキシ樹脂組成物を調製した。

【００１６】尚、表１及び表２において、＊１は住友化学工業（株）製「ＥＯＣＮ１９５Ｘ」、＊２は住友化学工業（株）製「ＥＳＢ４００Ｔ」、＊３は群栄化学工業（株）製「ＰＳＭ６２００」、＊４は三菱化学工業（株）製「ＭＡ－６００」、＊５は三菱化学工業（株）製「ＭＢ－１００Ｂ」、＊６は住友化学工業（株）製「ＬＭ－１」

【００１７】

【表１】

（重量部）

	実施例1	実施例2	実施例3	実施例4	比較例1
o-クレゾールノボラック型エポキシ樹脂 *1	170	170	170	170	170
ブロム化エポキシ樹脂 *2	18	18	18	18	18
フェノールノボラック樹脂 *3	92	92	92	92	92
2-メチルイミダゾール	3	3	3	3	3
溶融シリカ	672	671	672.5	669	673
三酸化アンチモン	27	27	27	27	27
カルナバワックス	8	8	8	8	8
γ-グリシドキシプロピルトリメトキシシラン	5	5	5	5	5
カーボンブラック 粒径20mm pH7.0 *4	1	2	1.5	4	−
カーボンブラック 粒径22mm pH3.5 *5	−	−	−	−	4
アゾ系染料 *6	4	4	3	4	−
合計	1000	1000	1000	1000	1000

【００１８】

＊＊【表２】

（重量部）

	比較例2	比較例3	比較例4	比較例5	比較例6	比較例7
o-クレゾールノボラック型エポキシ樹脂 *1	170	170	170	170	170	170
ブロム化エポキシ樹脂 *2	18	18	18	18	18	18
フェノールノボラック樹脂 *3	92	92	92	92	92	92
2-メチルイミダゾール	2	3	3	3	3	3
溶融シリカ	674	673	672.7	663	672.7	663
三酸化アンチモン	27	27	27	27	27	27
カルナバワックス	8	8	8	8	8	8
γ-グリシドキシプロピルトリメトキシシラン	5	5	5	5	5	5
カーボンブラック 粒径20mm pH7.0 *4	−	4	0.3	10	4	4
カーボンブラック 粒径22mm pH3.5 *5	−	−	−	−	−	−
アゾ系染料 *6	4	−	4	4	0.3	10
合計	1000	1000	1000	1000	1000	1000

【００１９】上記のようにして調製した封止用エポキシ　50　樹脂を低圧トンラスファー成形機を用い、１７５℃、９

０秒の条件で封止成形することによって、１６ピンＤＩＰ－ＩＣを作製した。この１６ピンＤＩＰ－ＩＣを試料として用い、ＰＣＴ（プレッシャークッカーテスト）とＵＳＰＣＢＴ（Un Saturated Pressure Cooker Baias Test ：不飽和高温高圧高湿バイアステスト）の試験を行ない、耐湿信頼性を評価した。

【００２０】ＰＣＴ試験は、試料を２気圧、１２１℃、１００％ＲＨ、１０００時間の条件で処理し、１０個の試料のうち何個に回路不良が発生したかをカウントして行なった。結果を表３に、分母に試料数、分子に回路不良数を表示して示す。ＵＳＰＣＢＴ試験は、８５℃、８５％ＲＨの条件下で、試料の平行した２本の回路間に２５Ｖの電圧をかけて５００時間処理したときに、１０個の試料のうち何個に断線やリークが発生したかをカウントして行なった。結果を表３に、分母に試料数、分子に回路不良数を表示して示す。

【００２１】また上記の１６ピンＤＩＰ－ＩＣを試料と＊して用い、レーザーマーキング性を評価した。レーザーマーキング性の評価は、CO_2 レーザーを用いてレーザーマーキングし、太陽光下で３０ｃｍ離れた位置からレーザーマークを観察することによって行なった。結果を、レーザーマークが見えたものを「○」、見えないものを「×」として判定し、表３に示す。

【００２２】さらに、上記のようにして調製した封止用エポキシ樹脂組成物について、可視光及び赤外光の透過性を評価した。透過性の評価は、１７０℃、９０秒の条件で封止用エポキシ樹脂組成物をトランスファー成形して、面積が２cm^2 で厚み０．３mm、面積が２cm^2 で厚み０．５mmの成形品を作製し、この成形品について自記分光光度計（日立製作所製「Ｕ－２４００」）を用いて波長３００ｎｍ～２０００ｎｍの光の透過率を測定することによって行なった。結果を表３に示す。

【００２３】

【表３】

			実施例1	実施例2	実施例3	実施例4	比較例1
PCT			3/10	1/10	0/10	5/10	6/10
USPCBT			3/10	1/10	0/10	5/10	6/10
レーザーマーキング性			○	○	○	○	×
透過率％	波長1500nm	厚み0.5mm	0	0	0	0	0
		厚み0.3mm	1	0	0	0	0
	波長1300nm	厚み0.5mm	0	0	0	0	0
		厚み0.3mm	0.1	0	0	0	0

			比較例2	比較例3	比較例4	比較例5	比較例6	比較例7
PCT			10/10	2/10	10/10	5/10	0/10	10/10
USPCBT			10/10	2/10	10/10	5/10	0/10	10/10
レーザーマーキング性			○	×	○	×	×	○
透過率％	波長1500nm	厚み0.5mm	0	0	0	0	0	0
		厚み0.3mm	15	0	4	0	0	0
	波長1300nm	厚み0.5mm	0	0	0	0	0	0
		厚み0.3mm	4	0	0.3	0	0	0

【００２４】

【発明の効果】上記のように本発明は、エポキシ樹脂、硬化剤、硬化促進剤、無機充填剤を主成分とし、平均粒径が２０ｎｍ以下でｐＨが７．０以上のカーボンブラックを０．０５～０．５重量％、アゾ系有機染料を０．０５～０．５重量％それぞれ配合して成ることを特徴とするものであり、アゾ系有機染料の配合によってレーザーマークの鮮明度を高めることができ、またカーボンブラックの配合によって可視光及び赤外光の透過を抑制することができるものであり、しかもカーボンブラックとして平均粒径やｐＨが上記のものを用いると共にカーボンブラックやアゾ系染料の配合量を上記のように設定することによって、耐湿信頼性が低下することを防ぐことができるものである。

9

【００２５】また請求項２の発明は、カーボンブラックの配合量を０．２～０．５重量％にしたので、可視光や赤外光の透過防止、耐湿信頼性向上、レーザマークの鮮明化の効果を良好に得ることができるものである。また＊

10

＊請求項３の発明は、アゾ系有機染料の配合量を０．２～０．５重量％にしたので、レーザマークの鮮明化及び耐湿信頼性向上の効果を良好に得ることができるものである。

フロントページの続き

(51)Int.Cl.[6]	識別記号	FI		
Ｈ０１Ｌ	23/29	Ｃ０８Ｇ	59/18	
	23/31	Ｈ０１Ｌ	23/30	R
// Ｃ０８Ｇ	59/18			

(72)発明者　市川　貴之
大阪府門真市大字門真1048番地松下電工株式会社内

PATENT ABSTRACTS OF JAPAN

(11)Publication number : **11-060904**
(43)Date of publication of application : **05.03.1999**

(51)Int.Cl.

C08L 63/00
C08K 3/00
C08K 3/04
C08K 5/23
H01L 23/29
H01L 23/31
// C08G 59/18

(21)Application number : **09-228695**
(22)Date of filing : **26.08.1997**

(71)Applicant : **MATSUSHITA ELECTRIC WORKS LTD**
(72)Inventor : **HARA RYUZO**
TOYAMA TAKASHI
KUSHIDA TAKANORI
ICHIKAWA TAKAYUKI

(54) EPOXY RESIN COMPOSITION FOR SEALING AND SEMICONDUCTOR DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To obtain the subject composition that can form clear laser mark and suppress the transmission of visible and infrared rays by admixing specific amounts of a specific carbon black and an azo organic dye to an epoxy resin, respectively.
SOLUTION: The objective composition includes (A) 10-25 wt.% of an epoxy resin as an o-cresol novolak type epoxy resin, (B) 5-13 wt.% of a curing agent, for example, a resol novolak resin, (C) 0.1-0.4 wt.% of a curing accelerator as 2-methylimidazole, (D) 60-80 wt.% of an inorganic filler as molten silica, (E) 0.05-0.5 wt.%, preferably 0.2-0.5 wt.% of carbon black with an average particle size of ≤20 nm and a pH of 7.0, (F) 0.05-0.5 wt.%, preferably 0.2-0.5 wt.% of an azo organic dye, and (G), when necessary, a mold-releasing agent, a silane-coupling agent, a flame-retardant, a silicone flexibilizer and the like. This composition is used to seal semiconductors thereby giving semiconductor devices.

LEGAL STATUS

[Date of request for examination]	22.12.1999
[Date of sending the examiner's decision of rejection]	17.12.2002
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]	
[Date of final disposal for application]	
[Patent number]	

[Date of registration]

[Number of appeal against examiner's decision of rejection] 2003-001001

[Date of requesting appeal against examiner's decision of rejection] 16.01.2003

[Date of extinction of right]

CLAIMS

[Claim(s)]

[Claim 1] The epoxy resin constituent for the closures with which an epoxy resin, a curing agent, a hardening accelerator, and an inorganic bulking agent are used as a principal component, and a mean diameter is characterized by for pH blending 7.0 or more carbon black 0.05 to 0.5% of the weight, respectively, and changing 0.05 - 0.5 % of the weight, and azo organic dye in it by 20nm or less.

[Claim 2] The epoxy resin constituent for the closures according to claim 1 characterized by ****ing the loadings of carbon black to 0.2 - 0.5% of the weight, and changing.

[Claim 3] The epoxy resin constituent for the closures according to claim 1 or 2 characterized by ****ing the loadings of azo organic dye to 0.2 - 0.5% of the weight, and changing.

[Claim 4] The semiconductor device characterized by carrying out the closure of the semi-conductor and changing with claim 1 thru/or one epoxy resin constituent for the closures of 3.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the semiconductor device using the epoxy resin constituent for the closures used in order to close electronic parts, such as a semi-conductor, and this epoxy resin constituent for the closures.

[0002]

[Description of the Prior Art] Although the hermetic-sealing method using the resin seal approach by the epoxy resin, silicon resin, etc., glass, a metal, a ceramic, etc. has been adopted from the former as the closure approaches, such as electrical and electric equipment, such as diode, a transistor, and an integrated circuit, electronic parts, and a semiconductor device, in recent years, the resin seal by low voltage transfer molding using the epoxy resin constituent which was excellent in high-volume production capability or a cost merit with improvement in dependability occupies the mainstream. What uses a cresol novolak mold epoxy resin as a resinous principle, and uses phenol novolak resin as a curing agent component as this epoxy resin constituent is the most common.

[0003] On the other hand, in carrying out marking of a product name, the manufacturer name, etc. to the product front face of the semiconductor device which carried out the resin seal, the method of sealing thermosetting resin ink from the former is common, but the mark in ink disappears comparatively easily by an organic solvent etc., and friction also has the fault of being weak. Then, it is CO2 in order to attain the increase in efficiency of a marking process, while compensating these faults. By irradiating the front face of the semiconductor device which carried out the resin seal of the laser, such as laser, displaying a product name, a manufacturer name, etc. by laser marking is performed increasingly. It seems that it disappears neither by the organic solvent nor friction since laser marking expresses a mark with irregularity.

[0004]
[Problem(s) to be Solved by the Invention] Although carbon black was generally blended with the epoxy resin constituent for the closures used for the resin seal of a semiconductor device and it was colored it black, laser marking performed on the front face of the closure mold goods of such a black semiconductor device had a problem in visibility. Then, although blending organic dye instead of carbon black, and raising the visibility of laser marking was examined, when the thickness of the closure resin which closes the semiconductor chip of a semiconductor device was thin, there was a problem that there was a possibility that the light and infrared light may penetrate closure mold goods, and there may be a possibility that a semiconductor device may malfunction, and the humidity-tolerant reliability of a semiconductor device may fall.
[0005] This invention is made in view of the above-mentioned point, while being able to form a clear laser mark, transparency of the light and infrared light can be controlled, and it aims at offering the epoxy resin constituent for the closures and semiconductor device which were moreover excellent in humidity-tolerant reliability.
[0006]
[Means for Solving the Problem] The epoxy resin constituent for the closures concerning this invention uses an epoxy resin, a curing agent, a hardening accelerator, and an inorganic bulking agent as a principal component, and pH is characterized by for a mean diameter blending 7.0 or more carbon black 0.05 to 0.5% of the weight 0.05 to 0.5% of the weight by 20nm or less, respectively, and changing azo organic dye.
[0007] Moreover, invention of claim 2 is characterized by ****ing the loadings of carbon black to 0.2 - 0.5% of the weight, and changing. Moreover, invention of claim 3 is characterized by ****ing the loadings of azo organic dye to 0.2 - 0.5% of the weight, and changing. The semiconductor device concerning this invention is characterized by carrying out the closure of the semi-conductor and changing with the above-mentioned epoxy resin constituent for the closures.
[0008]
[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained. Although it can use without being restricted if it is used for the semi-conductor closures as an epoxy resin in this invention, o-cresol novolak mold epoxy resin, a biphenyl mold epoxy resin, a dicyclopentadiene mold epoxy resin, the bisphenol A mold epoxy resin, a bisphenol female mold epoxy resin, a bromine content mold epoxy resin, etc. can be mentioned, for example.
[0009] Moreover, although it will not be restricted as a curing agent especially if it is for epoxy resin hardening, phenol system resin, such as phenol novolak resin, cresol novolak resin, phenol aralkyl resin, naphthol aralkyl resin, and various kinds of polyhydric-phenol resin, can be mentioned, for example. Although not furthermore restricted especially as a hardening accelerator, imidazole derivatives, such as the third class amines, such as organic phosphines, such as triphenyl phosphine, and diazabicycloundecen, 2-methylimidazole, and 2-phenylimidazole, can be used.
[0010] Moreover, as an inorganic bulking agent, the thing of the arbitration used for the semi-conductors closures, such as fused silica, a crystal silica, an alumina, and silicon nitride, can be used. And in this invention, although carbon black is blended as a coloring agent, mean particle diameter is 20nm or less as carbon black, and pH uses 7.0 or more things. As for carbon black, the dispersibility of the one where mean particle diameter is smaller in the inside of the epoxy resin constituent for the closures improves, wettability with an epoxy resin and the flow nature at the time of shaping of the epoxy resin constituent for the closures improve, adhesion with a leadframe etc. increases, and such effectiveness cannot be expected in the carbon black by which mean particle diameter exceeds 20nm. Although especially the minimum of the mean particle diameter of carbon black is not specified, about 10nm is a minimum practical. Moreover, it is thought that pH of carbon black causes leak at the time of electrical property evaluation of USPCBT etc. by it being less than 7.0, i.e., acidity, and the dependability of the semiconductor device which carried out the resin seal falls. Although especially the upper limit of pH of carbon black is not specified, about 9.0 pH is an upper limit practical. Thus, the humidity-tolerant reliability of the semiconductor device which mean particle diameter is 20nm or less as carbon black, and carried out the resin seal when

pH used 7.0 or more things can be raised.
[0011] Furthermore by this invention, azo organic dye is blended as a coloring agent. Azo dye is a color which has azo in a chromophore, and can use the thing of arbitration, such as basic dye, acid dye, acid mordant dye, metal-containing acid dye, direct dye, an azoic color, and reactive dye. The epoxy resin constituent for the closures which carries out a deer and is applied to this invention Use an epoxy resin, a curing agent, a hardening accelerator, and an inorganic bulking agent as a principal component, and above-mentioned carbon black and azo dye are blended with this as a coloring agent. Furthermore, the need is accepted. Carnauba wax, stearic acid, a montanoic acid, After blending release agents, such as carboxyl group content polyolefine, a silane coupling agent, a flame retarder, a silicone flexibilizer, etc. and mixing this to homogeneity with a blender etc., it can prepare by carrying out heating kneading with a kneader or a roll. And you may make it use it for powder etc., carrying out cooling solidification, grinding this kneading object if needed, and carrying out.
[0012] Here, as for the loadings of each above-mentioned component, it is desirable among the whole quantity of the epoxy resin constituent for the closures that an epoxy resin sets up ten to 25% of the weight so that a hardening accelerator may become and an inorganic bulking agent may become [a curing agent] 60 - 80% of the weight of the range 0.1 to 0.4% of the weight five to 13% of the weight. And the loadings of carbon black are set up so that it may become 0.05 - 0.5% of the weight to the whole quantity of the epoxy resin constituent for the closures. If it becomes impossible to prevent that the light and infrared light penetrate to the closure mold goods of the semiconductor device closed with the epoxy resin constituent for the closures as the loadings of carbon black are less than 0.05 % of the weight and the loadings of carbon black exceed 0.5 % of the weight conversely, the humidity-tolerant reliability of the semiconductor device closed with the epoxy resin constituent for the closures will worsen, and the visibility of the mark by laser marking will also worsen. The loadings of carbon black with the best effectiveness of clear-izing of transparency prevention of the light or infrared light, the improvement in humidity-tolerant reliability, and a laser mark are 0.2 - 0.5 % of the weight to the whole quantity of the epoxy resin constituent for the closures.
[0013] Moreover, the loadings of azo organic dye are set up so that it may become 0.05 - 0.5% of the weight to the whole quantity of the epoxy resin constituent for the closures. It is CO2 to the front face of the closure mold goods of the semiconductor device closed with the epoxy resin constituent for the closures. When laser, such as laser, performs laser marking, contrast of the irregularity of a laser mark is enlarged and it enables it to raise the visibility of a laser mark by blending azo organic dye by coloring by the azo organic dye which has a chromophore. Therefore, the loadings of azo organic dye cannot fully acquire the effectiveness which raises the visibility of a laser mark at less than 0.05 % of the weight. Conversely, if the loadings of azo organic dye exceed 0.5 % of the weight, the humidity-tolerant reliability of the semiconductor device closed with the epoxy resin constituent for the closures will worsen. The loadings of azo organic dye with the best effectiveness of clear-izing of a laser mark and the improvement in humidity-tolerant reliability are 0.2 - 0.5 % of the weight to the whole quantity of the epoxy resin constituent for the closures.
[0014] Thus, in order to acquire the effectiveness of transparency prevention of clear-izing of a laser mark, the light, or infrared light, and the improvement in humidity-tolerant reliability the best, it is 0.2 - 0.5 % of the weight about the loadings of carbon black, and it is desirable to set up the loadings of azo organic dye to 0.2 - 0.5% of the weight. And by carrying out closure shaping using the epoxy resin constituent for the closures prepared as mentioned above, a semiconductor device is producible. For example, the semiconductor device which closed the semi-conductor to the mold goods by the epoxy resin constituent for the closures is producible by setting to transfer-molding metal mold the leadframe which carried semi-conductors, such as IC, and performing low voltage transfer molding.
[0015]
[Example] An example explains this invention concretely below. After having blended each component shown in Table 1 or 2, mixing this to homogeneity for 5 minutes with the blender and

kneading for about 5 minutes on conditions with a temperature of 85 degrees C subsequently using a kneader, the epoxy resin constituent for the closures of examples 1-4 and the examples 1-7 of a comparison was prepared by grinding.
[0016] in addition, Table 1 and 2 -- setting -- *1 -- the Sumitomo Chemical Co., Ltd. make -- "EOCN195X" *2 -- the Sumitomo Chemical Co., Ltd. make -- "ESB400T" *3 -- the Gun-ei Chemical Industry Co., Ltd. make -- "PSM6200" *4 -- the product made from Mitsubishi Chemical Industry -- "MA-600" *5 -- the product made from Mitsubishi Chemical Industry -- "MB-100B" *6 -- "LM-1" by Sumitomo Chemical Co., Ltd.
[0017]
[Table 1]

（重量部）

	実施例1	実施例2	実施例3	実施例4	比較例1
o-クレゾールノボラック型エポキシ樹脂 *1	170	170	170	170	170
ブロム化エポキシ樹脂 *2	18	18	18	18	18
フェノールノボラック樹脂 *3	92	92	92	92	92
2-メチルイミダゾール	3	3	3	3	3
溶融シリカ	672	671	672.5	669	673
三酸化アンチモン	27	27	27	27	27
カルナバワックス	8	8	8	8	8
γ-グリシドキシプロピルトリメトキシシラン	5	5	5	5	5
カーボンブラック 粒径20nm pH7.0 *4	1	2	1.5	4	—
カーボンブラック 粒径22nm pH3.5 *5	—	—	—	—	4
アゾ系染料 *6	4	4	3	4	—
合計	1000	1000	1000	1000	1000

[0018]
[Table 2]

（重量部）

	比較例2	比較例3	比較例4	比較例5	比較例6	比較例7
ｏ-クレゾールノボラック型エポキシ樹脂 *1	170	170	170	170	170	170
ブロム 化エポキシ樹脂 *2	18	18	18	18	18	18
フェノールノボラック樹脂 *3	92	92	92	92	92	92
2-メチルイミダゾール	2	3	3	3	3	3
溶融シリカ	674	673	672.7	663	672.7	663
三酸化アンチモン	27	27	27	27	27	27
カルナバワックス	8	8	8	8	8	8
γ-グリシドキシプロピルトリメトキシシラン	5	5	5	5	5	5
カーボンブラック 粒径20nm pH7.0 *4	—	4	0.3	10	4	4
カーボンブラック 粒径22nm pH3.5 *5	—	—	—	—	—	—
アゾ系染料 *6	4	—	4	4	0.3	10
合計	1000	1000	1000	1000	1000	1000

[0019] 16 pin DIP-IC was produced by carrying out closure shaping of the epoxy resin for the closures prepared as mentioned above on 175 degrees C and the conditions for 90 seconds using a low voltage ton lath fur making machine. Using this 16 pin DIP-IC as a sample, the trial of PCT (pressure cooker test) and USPCBT (Un Saturated Pressure Cooker Baias Test : partial saturation elevated-temperature high-pressure highly humid bias test) was performed, and humidity-tolerant reliability was evaluated.

[0020] The PCT trial processed the sample on two atmospheric pressures, 121 degrees C, 100%RH, and the conditions of 1000 hours, counted whether the poor circuit occurred to how many [of ten samples], and performed it to. The number of samples is displayed on a denominator, the number of poor circuits is displayed on a molecule, and a result is shown in Table 3. When it processed under the conditions of 85 degrees C and 85%RH for 500 hours, having applied [of 25V] it between two circuits where the sample was parallel, the USPCBT trial counted whether an open circuit and leak occurred to how many [of ten samples], and performed it to. The number of samples is displayed on a denominator, the number of poor circuits is displayed on a molecule, and a result is shown in Table 3.

[0021] Moreover, laser marking nature was evaluated, using above-mentioned 16 pin DIP-IC as a sample. Evaluation of laser marking nature is CO2. Laser marking was carried out using laser and it carried out by observing a laser mark from the location distant 30cm under sunlight. "O" and the thing which is not visible are judged as "x", and that whose laser mark could be seen in the result is shown in Table 3.

[0022] Furthermore, the permeability of the light and infrared light was evaluated about the epoxy resin constituent for the closures prepared as mentioned above. Penetrable evaluation transfer-molds the epoxy resin constituent for the closures on 170 degrees C and the conditions for 90 seconds, and area is 2 2cm. The thickness of 0.3mm and area are 2 2cm. Mold goods with a thickness of 0.5mm were produced and it carried out by measuring the permeability of light with a wavelength of 300nm - 2000nm using a recording spectrophotometer ("U-2400" by Hitachi) about these mold goods. A result is shown in Table 3.

[0023]
[Table 3]

			実施例1	実施例2	実施例3	実施例4	比較例1
PCT			3/10	1/10	0/10	5/10	6/10
USPCBT			3/10	1/10	0/10	5/10	6/10
レーザーマーキング性			○	○	○	○	×
透過率%	波長1500nm	厚み0.5mm	0	0	0	0	0
		厚み0.3mm	1	0	0	0	0
	波長1300nm	厚み0.5mm	0	0	0	0	0
		厚み0.3mm	0.1	0	0	0	0

			比較例2	比較例3	比較例4	比較例5	比較例6	比較例7
PCT			10/10	2/10	10/10	5/10	0/10	10/10
USPCBT			10/10	2/10	10/10	5/10	0/10	10/10
レーザーマーキング性			○	×	○	×	×	○
透過率%	波長1500nm	厚み0.5mm	0	0	0	0	0	0
		厚み0.3mm	15	0	4	0	0	0
	波長1300nm	厚み0.5mm	0	0	0	0	0	0
		厚み0.3mm	4	0	0.3	0	0	0

[0024]
[Effect of the Invention] This invention uses an epoxy resin, a curing agent, a hardening accelerator, and an inorganic bulking agent as a principal component as mentioned above. pH 7.0 or more carbon black by 20nm or less 0.05 - 0.5 % of the weight, [a mean diameter] It is what is characterized by blending azo organic dye 0.05 to 0.5% of the weight, respectively, and changing. Combination of azo organic dye can raise the visibility of a laser mark. Moreover, it is what can control transparency of the light and infrared light by combination of carbon black. And while using the thing of the above [a mean diameter or pH] as carbon black, by setting up the loadings of carbon black or azo dye as mentioned above, it can prevent humidity-tolerant reliability falling. [0025] Moreover, since invention of claim 2 carried out the loadings of carbon black to 0.2 - 0.5% of the weight, it can acquire the effectiveness of clear-izing of transparency prevention of the light or infrared light, the improvement in humidity-tolerant reliability, and a laser mark good. Moreover, since invention of claim 3 carried out the loadings of azo organic dye to 0.2 - 0.5% of the weight, it can acquire the effectiveness of clear-izing of a laser mark, and the improvement in humidity-tolerant reliability good.

TECHNICAL FIELD

[Field of the Invention] This invention relates to the semiconductor device using the epoxy resin constituent for the closures used in order to close electronic parts, such as a semi-conductor, and this epoxy resin constituent for the closures.

PRIOR ART

[Description of the Prior Art] Although the hermetic-sealing method using the resin seal approach by the epoxy resin, silicon resin, etc., glass, a metal, a ceramic, etc. has been adopted from the former as the closure approaches, such as electrical and electric equipment, such as diode, a transistor, and an integrated circuit, electronic parts, and a semiconductor device, in recent years, the resin seal by low voltage transfer molding using the epoxy resin constituent which was excellent in high-volume production capability or a cost merit with improvement in dependability occupies the mainstream. What uses a cresol novolak mold epoxy resin as a resinous principle, and uses phenol novolak resin as a curing agent component as this epoxy resin constituent is the most common.

[0003] On the other hand, in carrying out marking of a product name, the manufacturer name, etc. to the product front face of the semiconductor device which carried out the resin seal, the method of sealing thermosetting resin ink from the former is common, but the mark in ink disappears comparatively easily by an organic solvent etc., and friction also has the fault of being weak. Then, it is CO2 in order to attain the increase in efficiency of a marking process, while compensating these faults. By irradiating the front face of the semiconductor device which carried out the resin seal of the laser, such as laser, displaying a product name, a manufacturer name, etc. by laser marking is performed increasingly. It seems that it disappears neither by the organic solvent nor friction since laser marking expresses a mark with irregularity.

EFFECT OF THE INVENTION

[Effect of the Invention] This invention uses an epoxy resin, a curing agent, a hardening accelerator, and an inorganic bulking agent as a principal component as mentioned above. pH 7.0 or more carbon black by 20nm or less 0.05 - 0.5 % of the weight, [a mean diameter] It is what is characterized by blending azo organic dye 0.05 to 0.5% of the weight, respectively, and changing. Combination of azo organic dye can raise the visibility of a laser mark. Moreover, it is what can control transparency of the light and infrared light by combination of carbon black. And while using the thing of the above [a mean diameter or pH] as carbon black, by setting up the loadings of carbon black or azo dye as mentioned above, it can prevent humidity-tolerant reliability falling.

[0025] Moreover, since invention of claim 2 carried out the loadings of carbon black to 0.2 - 0.5% of the weight, it can acquire the effectiveness of clear-izing of transparency prevention of the light or infrared light, the improvement in humidity-tolerant reliability, and a laser mark good. Moreover, since invention of claim 3 carried out the loadings of azo organic dye to 0.2 - 0.5% of the weight, it can acquire the effectiveness of clear-izing of a laser mark, and the improvement in humidity-tolerant reliability good.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] Although carbon black was generally blended with the epoxy resin constituent for the closures used for the resin seal of a semiconductor device and it was colored it black, laser marking performed on the front face of the closure mold goods of such a black semiconductor device had a problem in visibility. Then, although blending organic dye instead of carbon black, and raising the visibility of laser marking was examined, when the thickness of the closure resin which closes the semiconductor chip of a semiconductor device was thin, there was a problem that there was a possibility that the light and infrared light may penetrate closure mold goods, and there may be a possibility that a semiconductor device may malfunction,

and the humidity-tolerant reliability of a semiconductor device may fall.
[0005] This invention is made in view of the above-mentioned point, while being able to form a clear laser mark, transparency of the light and infrared light can be controlled, and it aims at offering the epoxy resin constituent for the closures and semiconductor device which were moreover excellent in humidity-tolerant reliability.

MEANS

[Means for Solving the Problem] The epoxy resin constituent for the closures concerning this invention uses an epoxy resin, a curing agent, a hardening accelerator, and an inorganic bulking agent as a principal component, and pH is characterized by for a mean diameter blending 7.0 or more carbon black 0.05 to 0.5% of the weight 0.05 to 0.5% of the weight by 20nm or less, respectively, and changing azo organic dye.
[0007] Moreover, invention of claim 2 is characterized by ****ing the loadings of carbon black to 0.2 - 0.5% of the weight, and changing. Moreover, invention of claim 3 is characterized by ****ing the loadings of azo organic dye to 0.2 - 0.5% of the weight, and changing. The semiconductor device concerning this invention is characterized by carrying out the closure of the semi-conductor and changing with the above-mentioned epoxy resin constituent for the closures.
[0008]
[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained. Although it can use without being restricted if it is used for the semi-conductor closures as an epoxy resin in this invention, o-cresol novolak mold epoxy resin, a biphenyl mold epoxy resin, a dicyclopentadiene mold epoxy resin, the bisphenol A mold epoxy resin, a bisphenol female mold epoxy resin, a bromine content mold epoxy resin, etc. can be mentioned, for example.
[0009] Moreover, although it will not be restricted as a curing agent especially if it is for epoxy resin hardening, phenol system resin, such as phenol novolak resin, cresol novolak resin, phenol aralkyl resin, naphthol aralkyl resin, and various kinds of polyhydric-phenol resin, can be mentioned, for example. Although not furthermore restricted especially as a hardening accelerator, imidazole derivatives, such as the third class amines, such as organic phosphines, such as triphenyl phosphine, and diazabicycloundecen, 2-methylimidazole, and 2-phenylimidazole, can be used.
[0010] Moreover, as an inorganic bulking agent, the thing of the arbitration used for the semi-conductors closures, such as fused silica, a crystal silica, an alumina, and silicon nitride, can be used. And in this invention, although carbon black is blended as a coloring agent, mean particle diameter is 20nm or less as carbon black, and pH uses 7.0 or more things. As for carbon black, the dispersibility of the one where mean particle diameter is smaller in the inside of the epoxy resin constituent for the closures improves, wettability with an epoxy resin and the flow nature at the time of shaping of the epoxy resin constituent for the closures improve, adhesion with a leadframe etc. increases, and such effectiveness cannot be expected in the carbon black by which mean particle diameter exceeds 20nm. Although especially the minimum of the mean particle diameter of carbon black is not specified, about 10nm is a minimum practical. Moreover, it is thought that pH of carbon black causes leak at the time of electrical property evaluation of USPCBT etc. by it being less than 7.0, i.e., acidity, and the dependability of the semiconductor device which carried out the resin seal falls. Although especially the upper limit of pH of carbon black is not specified, about 9.0 pH is an upper limit practical. Thus, the humidity-tolerant reliability of the semiconductor device which mean particle diameter is 20nm or less as carbon black, and carried out the resin seal when pH used 7.0 or more things can be raised.
[0011] Furthermore by this invention, azo organic dye is blended as a coloring agent. Azo dye is a color which has azo in a chromophore, and can use the thing of arbitration, such as basic dye, acid dye, acid mordant dye, metal-containing acid dye, direct dye, an azoic color, and reactive dye. The epoxy resin constituent for the closures which carries out a deer and is applied to this invention Use an epoxy resin, a curing agent, a hardening accelerator, and an inorganic bulking agent as a

principal component, and above-mentioned carbon black and azo dye are blended with this as a coloring agent. Furthermore, the need is accepted. Carnauba wax, stearic acid, a montanoic acid, After blending release agents, such as carboxyl group content polyolefine, a silane coupling agent, a flame retarder, a silicone flexibilizer, etc. and mixing this to homogeneity with a blender etc., it can prepare by carrying out heating kneading with a kneader or a roll. And you may make it use it for powder etc., carrying out cooling solidification, grinding this kneading object if needed, and carrying out.

[0012] Here, as for the loadings of each above-mentioned component, it is desirable among the whole quantity of the epoxy resin constituent for the closures that an epoxy resin sets up ten to 25% of the weight so that a hardening accelerator may become and an inorganic bulking agent may become [a curing agent] 60 - 80% of the weight of the range 0.1 to 0.4% of the weight five to 13% of the weight. And the loadings of carbon black are set up so that it may become 0.05 - 0.5% of the weight to the whole quantity of the epoxy resin constituent for the closures. If it becomes impossible to prevent that the light and infrared light penetrate to the closure mold goods of the semiconductor device closed with the epoxy resin constituent for the closures as the loadings of carbon black are less than 0.05 % of the weight and the loadings of carbon black exceed 0.5 % of the weight conversely, the humidity-tolerant reliability of the semiconductor device closed with the epoxy resin constituent for the closures will worsen, and the visibility of the mark by laser marking will also worsen. The loadings of carbon black with the best effectiveness of clear-izing of transparency prevention of the light or infrared light, the improvement in humidity-tolerant reliability, and a laser mark are 0.2 - 0.5 % of the weight to the whole quantity of the epoxy resin constituent for the closures.

[0013] Moreover, the loadings of azo organic dye are set up so that it may become 0.05 - 0.5% of the weight to the whole quantity of the epoxy resin constituent for the closures. When laser, such as a CO2 laser, performs laser marking on the front face of the closure mold goods of the semiconductor device closed with the epoxy resin constituent for the closures, contrast of the irregularity of a laser mark is enlarged and it enables it to raise the visibility of a laser mark by blending azo organic dye by coloring by the azo organic dye which has a chromophore. Therefore, the loadings of azo organic dye cannot fully acquire the effectiveness which raises the visibility of a laser mark at less than 0.05 % of the weight. Conversely, if the loadings of azo organic dye exceed 0.5 % of the weight, the humidity-tolerant reliability of the semiconductor device closed with the epoxy resin constituent for the closures will worsen. The loadings of azo organic dye with the best effectiveness of clear-izing of a laser mark and the improvement in humidity-tolerant reliability are 0.2 - 0.5 % of the weight to the whole quantity of the epoxy resin constituent for the closures.

[0014] Thus, in order to acquire the effectiveness of transparency prevention of clear-izing of a laser mark, the light, or infrared light, and the improvement in humidity-tolerant reliability the best, it is 0.2 - 0.5 % of the weight about the loadings of carbon black, and it is desirable to set up the loadings of azo organic dye to 0.2 - 0.5% of the weight. And by carrying out closure shaping using the epoxy resin constituent for the closures prepared as mentioned above, a semiconductor device is producible. For example, the semiconductor device which closed the semi-conductor to the mold goods by the epoxy resin constituent for the closures is producible by setting to transfer-molding metal mold the leadframe which carried semi-conductors, such as IC, and performing low voltage transfer molding.

EXAMPLE

[Example] An example explains this invention concretely below. After having blended each component shown in Table 1 or 2, mixing this to homogeneity for 5 minutes with the blender and kneading for about 5 minutes on conditions with a temperature of 85 degrees C subsequently using a kneader, the epoxy resin constituent for the closures of examples 1-4 and the examples 1-7 of a comparison was prepared by grinding.

[0016] in addition, Table 1 and 2 -- setting -- *1 -- the Sumitomo Chemical Co., Ltd. make -- "EOCN195X" *2 -- the Sumitomo Chemical Co., Ltd. make -- "ESB400T" *3 -- the Gun-ei Chemical Industry Co., Ltd. make -- "PSM6200" *4 -- the product made from Mitsubishi Chemical Industry -- "MA-600" *5 -- the product made from Mitsubishi Chemical Industry -- "MB-100B" *6 -- "LM-1" by Sumitomo Chemical Co., Ltd.

[0017]

[Table 1]

(重量部)

	実施例1	実施例2	実施例3	実施例4	比較例1
o-クレゾールノボラック型エポキシ樹脂 *1	170	170	170	170	170
ブロム化エポキシ樹脂 *2	18	18	18	18	18
フェノールノボラック樹脂 *3	92	92	92	92	92
2-メチルイミダゾール	3	3	3	3	3
溶融シリカ	672	671	672.5	669	673
三酸化アンチモン	27	27	27	27	27
カルナバワックス	8	8	8	8	8
γ-グリシドキシプロピルトリメトキシシラン	5	5	5	5	5
カーボンブラック 粒径20nm pH7.0 *4	1	2	1.5	4	—
カーボンブラック 粒径22nm pH3.5 *5	—	—	—	—	4
アゾ系染料 *6	4	4	3	4	—
合計	1000	1000	1000	1000	1000

[0018]

[Table 2]

(重量部)

	比較例2	比較例3	比較例4	比較例5	比較例6	比較例7
ｏ-クレゾールノボラック型エポキシ樹脂 *1	170	170	170	170	170	170
ブロム化エポキシ樹脂 *2	18	18	18	18	18	18
フェノールノボラック樹脂 *3	92	92	92	92	92	92
2-メチルイミダゾール	2	3	3	3	3	3
溶融シリカ	674	673	672.7	663	672.7	663
三酸化アンチモン	27	27	27	27	27	27
カルナバワックス	8	8	8	8	8	8
γ-グリシドキシプロピルトリメトキシシラン	5	5	5	5	5	5
カーボンブラック 粒径20nm pH7.0 *4	—	4	0.3	10	4	4
カーボンブラック 粒径22nm pH3.5 *5	—	—	—	—	—	—
アゾ系染料 *6	4	—	4	4	0.3	10
合計	1000	1000	1000	1000	1000	1000

[0019] 16 pin DIP-IC was produced by carrying out closure shaping of the epoxy resin for the closures prepared as mentioned above on 175 degrees C and the conditions for 90 seconds using a low voltage ton lath fur making machine. Using this 16 pin DIP-IC as a sample, the trial of PCT (pressure cooker test) and USPCBT (Un Saturated Pressure Cooker Baias Test : partial saturation elevated-temperature high-pressure highly humid bias test) was performed, and humidity-tolerant reliability was evaluated.

[0020] The PCT trial processed the sample on two atmospheric pressures, 121 degrees C, 100%RH, and the conditions of 1000 hours, counted whether the poor circuit occurred to how many [of ten samples], and performed it to. The number of samples is displayed on a denominator, the number of poor circuits is displayed on a molecule, and a result is shown in Table 3. When it processed under the conditions of 85 degrees C and 85%RH for 500 hours, having applied [of 25V] it between two circuits where the sample was parallel, the USPCBT trial counted whether an open circuit and leak occurred to how many [of ten samples], and performed it to. The number of samples is displayed on a denominator, the number of poor circuits is displayed on a molecule, and a result is shown in Table 3.

[0021] Moreover, laser marking nature was evaluated, using above-mentioned 16 pin DIP-IC as a sample. Evaluation of laser marking nature is CO2. Laser marking was carried out using laser and it carried out by observing a laser mark from the location distant 30cm under sunlight. "O" and the thing which is not visible are judged as "x", and that whose laser mark could be seen in the result is shown in Table 3.

[0022] Furthermore, the permeability of the light and infrared light was evaluated about the epoxy resin constituent for the closures prepared as mentioned above. Penetrable evaluation transfer-molds the epoxy resin constituent for the closures on 170 degrees C and the conditions for 90 seconds, and area is 2 2cm. The thickness of 0.3mm and area are 2 2cm. Mold goods with a thickness of 0.5mm were produced and it carried out by measuring the permeability of light with a wavelength of 300nm - 2000nm using a recording spectrophotometer ("U-2400" by Hitachi) about these mold goods. A result is shown in Table 3.

[0023]
[Table 3]

			実施例1	実施例2	実施例3	実施例4	比較例1
PCT			3/10	1/10	0/10	5/10	6/10
USPCBT			3/10	1/10	0/10	5/10	6/10
レーザーマーキング性			○	○	○	○	×
透過率%	波長1500nm	厚み0.5mm	0	0	0	0	0
		厚み0.3mm	1	0	0	0	0
	波長1300nm	厚み0.5mm	0	0	0	0	0
		厚み0.3mm	0.1	0	0	0	0

			比較例2	比較例3	比較例4	比較例5	比較例6	比較例7
PCT			10/10	2/10	10/10	5/10	0/10	10/10
USPCBT			10/10	2/10	10/10	5/10	0/10	10/10
レーザーマーキング性			○	×	○	×	×	○
透過率%	波長1500nm	厚み0.5mm	0	0	0	0	0	0
		厚み0.3mm	15	0	4	0	0	0
	波長1300nm	厚み0.5mm	0	0	0	0	0	0
		厚み0.3mm	4	0	0.3	0	0	0